

2/PPTS

## METHOD FOR PLAYING A RECORDING MEDIUM

~~Background Information~~

A method for playing CDs in a compact disc player, in which the time prior to starting the playback of a selected music title is shortened, is <sup>described in</sup> ~~known from~~ German Patent No. 38 07 181. A cumulative total time code recorded in the CD lead-in area is read out, and a predetermined code is detected during this read-out. If this predetermined code cannot be detected in the cumulative total time code, a frame calculation is carried out to tell the scanner to jump across the CD tracks and read out a different cumulative total time code, whereupon, after the predetermined code has been read out, necessary data is output from the lead-in area. According to a music selection method, only the total playback time and the total number of music titles are read out from the total time code. After selecting a specific music title, the system calculates an average time per music title from the total playback time and the total number of music titles, and the system searches for the selected music number according to the average time calculated in this manner. The CD player can therefore use a low-capacity memory and can thus be produced economically. According to the system, the scanner is also essentially moved to the position of the selected music title without reading out the addresses provided for the music titles recorded on the CD.

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Advantages of the Invention

5 The method according to the present invention ~~having~~  
~~the features of the main claim~~ has an advantage over  
the related art in that the read device can be quickly  
and precisely positioned at the beginning of a selected  
title even if the title playback time varies from the  
average time. The method eliminates the need to  
determine the average time of each title, and the read  
10 device is accurately positioned at the beginning of the  
title independently of the playback time of the  
individual titles. Because the at least one address of  
a title beginning can be converted to and stored as a  
start time of exactly one time unit, the positioning  
15 time, or the number of tracks to be jumped, can be  
calculated directly from the start time stored in the  
memory, even if the address of the title beginning  
stored in the address area of the recording medium is  
represented by a combination of different time units,  
20 for example minutes and seconds. Converting the  
combined time units to exactly one time unit, for  
example to seconds, is no longer necessary prior to  
each read device track jump, thus saving time.

25 The features described in the subclaims provide  
advantageous embodiments and *a* refinements of the method  
indicated in the main claim.

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30 One particular advantage~~s~~ lies in the fact that, if a  
pause is detected at the beginning of a title, the  
pause duration is determined and added to the start  
time. Accounting for a pause at the beginning of a  
title when determining the start time makes it possible

to further shorten the access time for a selected title, since the read device also jumps the pause at the beginning of the title when performing a track jump, so that a pause of this type does not have to be played or skipped by additional jumps.

A further advantage is that the time unit is selected depending on the accuracy needed for calculating one track jump. This makes it possible to convert the start time directly to the jump time or to the number of tracks to be jumped when the read device performs a track jump without any further loss of time.

Drawing

One embodiment of the present invention is illustrated in the drawing and explained in greater detail in the description below, where Figure 1 shows a cross-section of a recording medium designed as an optical storage disc; Figure 2 shows a block diagram of a player with the recording medium inserted; Figure 3 shows a flowchart for evaluating an address area on a recording medium; and Figure 4 shows a flowchart for selecting a title.

Description of the Embodiment

In Figure 2, 15 designates a player designed as a compact-disc player into which is inserted a recording medium 1, designed as an optical storage disc, for example a compact disc. Compact disc 1 is rotated by a CD drive 7, and the recordings stored on it are scanned, i.e., read out, by a read device 9. Read

device 9 is located on a positioning arrangement 11,  
which moves read device 9 across compact disc 1 in a  
radial direction. A signal output 8 of read device 9 is  
connected to an input 17 of a decoder 12. An output 16  
of decoder 12 is connected to an input 18 of an  
evaluation circuit 10 and to a first input 20 of a  
memory 13. An output 19 of evaluation circuit 10 is  
connected to a second input 21 of memory 13 and to an  
input 23 of an adder 14.

An output 24 of adder 14 is connected to a third input  
22 of memory 13. An output 25 of memory 13 is connected  
to an input 26 of positioning arrangement 11.

Figure 1 shows a cross-sectional view of a recording  
medium 1 designed as a compact disc. An area 3 in which  
no data is recorded lies next to a central CD hole 2  
for adjusting compact disc 1 on a turntable, which is  
not illustrated in Figure 2. This area is followed by a  
run-in area 4 which contains information about the  
total number of titles recorded on the compact disc,  
the total playing time of the titles in minutes,  
seconds, and frames measuring, for example, one 75<sup>th</sup> of  
a second, and the address of each title. Each of the  
addresses stored in run-in area 4 relates to the  
beginning of one corresponding title and is stored in  
one or more address areas of run-in area 4. At least  
one address for one title is provided in run-in area 4.  
A program area 5 follows run-in area 4 and extends all  
the way to a CD edge 6, which varies depending on the  
CD size, the titles being recorded in this program  
area. The addresses for the beginning of each title are  
indicated in run-in area 4 in the form of a start time

for the corresponding title in minutes and seconds. The start time corresponds approximately to the playing time of recording medium 1 from the beginning of program area 5 to the addressed title beginning.

After compact disc 1 is inserted into player 15, the address data is converted to a single time unit the first time read device 9 scans run-in area 4, making it possible to convert each start time to the corresponding, necessary jump time or to the number of tracks to be jumped. The time unit is selected depending on the accuracy needed to calculate one track jump more quickly. Because the jump time accuracy or the number of tracks to be jumped can vary by one second, one second is selected as the time unit.

The address data scanned by read device 9 in run-in area 4 is first decoded by decoder 12 and then supplied to evaluation circuit 10, which converts the address data for the start times, provided in minutes and seconds, to seconds and stores it in memory 13. The jump time or the number of tracks to be jumped to position read device 9 from run-in area 4 or from any position in program area 5 to the start of the selected title in program area 5 of compact disc 1 can then be calculated by positioning arrangement 11 directly from the start times in seconds stored in memory 13, i.e., without any further time unit conversions. When the user selects a title, the current address of read device 9 is first determined in the form of the playing time from the beginning of program area 5 to the current position of read device 9 by scanning additional encoded information that is stored on

compact disc 1. The start time of the selected title is then determined from memory 13, and a relative jump time or number of tracks to be jumped on compact disc 1 is calculated from this start time and the current address of read device 9. According to the calculated jump time or the number of tracks to be jumped, positioning arrangement 11 then moves read device 9 to the beginning of the selected title on compact disc 1, and this title is played.

If decoder 12 detects a pause in the data read by read device 9 at the beginning of a title, evaluation circuit 10 determines the pause duration, and adder 14 adds this duration to the corresponding start time stored in memory 13, so that the next time the user selects this title, positioning arrangement 11 accounts for the pause during the track jump, and either the pause is not played or must be avoided by additional jumps. This further speeds up access to a title that begins with a pause.

Figure 3 shows a flowchart for evaluation circuit 10 when evaluating the addresses read in run-in area 4. At a program point 100, the address data, i.e., start times, of the titles recorded in program area 5 of compact disc 1 are read out of run-in area 4 by read device 9, then evaluated by decoder 12, and finally supplied to evaluation circuit 10 as data in the form of minutes and seconds. At program point 105, evaluation circuit 10 converts these start times to seconds. At program point 110, the converted start times are stored in memory 13. The program then leaves this subroutine.

Figure 4 shows a flowchart for selecting a title. At a program point 200, positioning arrangement 11 determines the current address of read device 9 from the additional encoded information scanned by read device 9 on compact disc 1, converts this address to the seconds time unit and, if the address is not already included in the seconds time unit of the additional encoded data, accesses the start time corresponding to the selected title in memory 13, which is also present in the one-second time unit, and, from this start time and the current address of read device 9, calculates a corresponding jump time or number of tracks to be jumped for positioning arrangement 11 to position read device 9 at the beginning of the selected title.

At a program point 205, positioning arrangement 11 performs a jump based on the calculated jump time or the number of tracks to be jumped before reaching the beginning of the selected title. At a program point 210, evaluation circuit 10 checks whether a pause occurs at the beginning of a title. A pause of this type can, for example, be identified by a special index ID on a corresponding recording track of compact disc 1 and decoded by decoder 12. If so, the sequence branches to program point 230, otherwise it branches to program point 215. At program point 215, selection circuit 10 determines the pause duration. At program step 220, adder 14 adds the pause duration to the corresponding start time in memory 13. At program point 225, the previous start time is overwritten by the new start time resulting from adding the pause duration. The sequence then branches to program point 230. At program

